

AUTHORS INDEX

- ADAMS, C. M. JR., M. C. FLEMINGS and H. F. TAYLOR — Solidification and Riser of Gray Iron Castings .. 369
- AFS MALLEABLE DIVISION CONTROLLED ANNEALING COMMITTEE — Malleable Iron Microstructures Effect and Cause 166
- AHEARN, P. J., H. M. GREEN and J. ZOTOS — Ductile High Strength Titanium Castings by Induction Melting .. 225
- ANTES, H. W., J. T. NORTON and R. E. EDELMAN — Foundry Characteristics of a Rammed Graphitic Mold Material for Casting Titanium 135
- ASCHOFF, W. A. and D. H. BLAIR — Problems Encountered in Casting Reactive Metals 257
- AUSMUS, S. L., E. D. CALVERT and F. W. WOOD — A Casting Technology for Reactive Metals 354
- BAER, W. H., M. GLASSENBERG and A. H. HESSE — Occurrence and Elimination of Leakage in a Gun Metal Casting 231
- BAKER, C. R., G. H. BASCOM and W. C. TRUCKENMILLER — Evaluation of Shell Molding Process Capability .. 81
- BARLOW, T. E. and H. W. DIETERT — Hot Deformation of Molding Sand 7
- BASCOM, G. H., W. C. TRUCKENMILLER and C. R. BAKER — Evaluation of Shell Molding Process Capability .. 81
- BLAIR, D. H. and W. A. ASCHOFF — Problems Encountered in Casting Reactive Metals 257
- BOVARNICK, B. and F. C. QUIGLEY — Sintered Alumina Molds for Investment Casting of Steels 247
- BRAMMER, W. N. — Melting Practice for Aluminum Casting Alloys 497
- BRICE, L. J. and G. A. BROUGHTON — Die and Permanent Mold Casting of Nonferrous Metals in the United Kingdom 466
- BROOKS, M. E. and J. G. HOUSE — Induction Melting in a Magnesium Sand Foundry 87
- BROUGHTON, G. A. and L. J. BRICE — Die and Permanent Mold Casting of Nonferrous Metals in the United Kingdom 466
- BUKOWSKI, A., E. A. LANGE and N. C. HOWELLS — Cast Age-Hardenable Austenitic Steels 519
- CAINE, J. B. and C. E. MCQUISTON — The Theoretical Concepts of the Packing of Small Particles 36
- CALVERT, E. D., F. W. WOOD and S. L. AUSMUS — A Casting Technology for Reactive Metals 354
- CLARK, L. L., W. ROSTOKER and A. H. MURPHY — Improvement of Castings by Press Forging 105
- COLLIGAN, G. A., L. H. VAN VLACK and R. A. FLINN — The Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction 452
- DAVIS, H. M. and A. PAL — On the Release of Hydrogen from Molten Aluminum 301
- DAVIS, M. V. and R. V. SCALCO — Foundry Practice for Sand Casting Commercially Pure Aluminum 238
- DAWSON, J. V. and L. W. L. SMITH — Gases in Cast Iron with Special Reference to Pickup of Hydrogen in Sand Molds 17
- DEROSS, A. B. — High Strength Aluminum Alloy X357 Properties and Aging Practice 480
- DICKERSON, R. F. and A. W. HARE — A Method of Casting Radiator-type Fuel Elements for A Nuclear Reactor .. 210
- DIETERT, H. W. and T. E. BARLOW — Hot Deformation of Molding Sand 7
- DONOHU, C. K. and J. F. ELLIS — Magnesium Content and Graphite Forms in Cast Iron 203
- DOST, F. J. and G. P. RIBAR — Prevention by the Ounce .. 433
- DREHER, G. K. — How Patternmakers can Help to Sell Castings 583
- ECKEL, E. J. — A study of the Ferritization of Nodular Iron 151
- EDELMAN, R. E., H. W. ANTES and J. T. NORTON — Foundry Characteristics of a Rammed Graphitic Mold Material for Casting Titanium 135
- ELLIS, J. F. and C. K. DONOHU — Magnesium Content and Graphite Forms in Cast Iron 203
- EVANS, E. B. and J. F. WALLACE — Riser of Gray Iron Castings 49
- FAIRFIELD, H. H. and J. A. ORTIZ — Some Factors Affecting the Toughness of Mild Steel Castings 344
- FAUSEL, C. E. — Your Foundry and Preventive Maintenance 446
- FEINBERG, I. J. and J. D. GRIMSLEY — Tensile Properties of Microshrinkage-Graded AZ-63 Magnesium Alloy 409
- FITTERER, G. R. and S. A. PRUSSIN — Some Requirements for Successful Fluidity Testing 143
- FLEMINGS, D. — The Controlled-Slag Hot-Blast Cupola .. 113
- FLEMINGS, M. C., H. F. TAYLOR and C. M. ADAMS, JR. — Solidification and Riser of Gray Iron Castings 369
- FLEMINGS, M. C., H. F. TAYLOR and E. M. PASSMORE — Fundamental Studies on Effects of Solution Treatment, Iron Content and Chilling of Sand Cast Aluminum-Copper Alloy 96
- FLEMINGS, M. C., H. F. TAYLOR and S. Z. URAM — Effect of Pressure During Solidification on Microporosity in Aluminum Alloys 129
- FLEMINGS, M. C., R. W. STRACHAN, E. J. POIRIER and H. F. TAYLOR — Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses 336
- FLEMINGS, M. C., R. W. STRACHAN, E. J. POIRIER and H. F. TAYLOR — Rigging Design of High Strength Magnesium Alloy Castings 241
- FLINN, R. A. and C. R. MIELKE — Effects of Foundry Variables upon Porosity of 85-5-5-5 Bronze 391
- FLINN, R. A., G. A. COLLIGAN and L. H. VAN VLACK — The Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction 452
- GEARY, E. A. — Pattern Standards for Practical Foundry Usage 556
- GERTSMAN, S. L. and A. E. MURTON — A Literature Review of Metal Penetration 1
- GLASSENBERG, M., A. H. HESSE and W. H. BAER — Occurrence and Elimination of Leakage in a Gun Metal Casting 231
- GREEN, H. M., J. ZOTOS and P. J. AHEARN — Ductile High Strength Titanium Castings by Induction Melting .. 225

AUTHORS INDEX

- ADAMS, C. M. JR., M. C. FLEMINGS and H. F. TAYLOR — Solidification and Riser of Gray Iron Castings .. 369
- AFS MALLEABLE DIVISION CONTROLLED ANNEALING COMMITTEE — Malleable Iron Microstructures Effect and Cause 166
- AHEARN, P. J., H. M. GREEN and J. ZOTOS — Ductile High Strength Titanium Castings by Induction Melting .. 225
- ANTES, H. W., J. T. NORTON and R. E. EDELMAN — Foundry Characteristics of a Rammed Graphitic Mold Material for Casting Titanium 135
- ASCHOFF, W. A. and D. H. BLAIR — Problems Encountered in Casting Reactive Metals 257
- AUSMUS, S. L., E. D. CALVERT and F. W. WOOD — A Casting Technology for Reactive Metals 354
- BAER, W. H., M. GLASSENBERG and A. H. HESSE — Occurrence and Elimination of Leakage in a Gun Metal Casting 231
- BAKER, C. R., G. H. BASCOM and W. C. TRUCKENMILLER — Evaluation of Shell Molding Process Capability .. 81
- BARLOW, T. E. and H. W. DIETERT — Hot Deformation of Molding Sand 7
- BASCOM, G. H., W. C. TRUCKENMILLER and C. R. BAKER — Evaluation of Shell Molding Process Capability .. 81
- BLAIR, D. H. and W. A. ASCHOFF — Problems Encountered in Casting Reactive Metals 257
- BOVARNICK, B. and F. C. QUIGLEY — Sintered Alumina Molds for Investment Casting of Steels 247
- BRAMMER, W. N. — Melting Practice for Aluminum Casting Alloys 497
- BRICE, L. J. and G. A. BROUGHTON — Die and Permanent Mold Casting of Nonferrous Metals in the United Kingdom 466
- BROOKS, M. E. and J. G. HOUSE — Induction Melting in a Magnesium Sand Foundry 87
- BROUGHTON, G. A. and L. J. BRICE — Die and Permanent Mold Casting of Nonferrous Metals in the United Kingdom 466
- BUKOWSKI, A., E. A. LANGE and N. C. HOWELLS — Cast Age-Hardenable Austenitic Steels 519
- CAINE, J. B. and C. E. MCQUISTON — The Theoretical Concepts of the Packing of Small Particles 36
- CALVERT, E. D., F. W. WOOD and S. L. AUSMUS — A Casting Technology for Reactive Metals 354
- CLARK, L. L., W. ROSTOKER and A. H. MURPHY — Improvement of Castings by Press Forging 105
- COLLIGAN, G. A., L. H. VAN VLACK and R. A. FLINN — The Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction 452
- DAVIS, H. M. and A. PAL — On the Release of Hydrogen from Molten Aluminum 301
- DAVIS, M. V. and R. V. SCALCO — Foundry Practice for Sand Casting Commercially Pure Aluminum 238
- DAWSON, J. V. and L. W. L. SMITH — Gases in Cast Iron with Special Reference to Pickup of Hydrogen in Sand Molds 17
- DEROSS, A. B. — High Strength Aluminum Alloy X357 Properties and Aging Practice 480
- DICKERSON, R. F. and A. W. HARE — A Method of Casting Radiator-type Fuel Elements for A Nuclear Reactor .. 210
- DIETERT, H. W. and T. E. BARLOW — Hot Deformation of Molding Sand 7
- DONOHU, C. K. and J. F. ELLIS — Magnesium Content and Graphite Forms in Cast Iron 203
- DOST, F. J. and G. P. RIBAR — Prevention by the Ounce .. 433
- DREHER, G. K. — How Patternmakers can Help to Sell Castings 583
- ECKEL, E. J. — A study of the Ferritization of Nodular Iron 151
- EDELMAN, R. E., H. W. ANTES and J. T. NORTON — Foundry Characteristics of a Rammed Graphitic Mold Material for Casting Titanium 135
- ELLIS, J. F. and C. K. DONOHU — Magnesium Content and Graphite Forms in Cast Iron 203
- EVANS, E. B. and J. F. WALLACE — Riser of Gray Iron Castings 49
- FAIRFIELD, H. H. and J. A. ORTIZ — Some Factors Affecting the Toughness of Mild Steel Castings 344
- FAUSEL, C. E. — Your Foundry and Preventive Maintenance 446
- FEINBERG, I. J. and J. D. GRIMSLEY — Tensile Properties of Microshrinkage-Graded AZ-63 Magnesium Alloy 409
- FITTERER, G. R. and S. A. PRUSSIN — Some Requirements for Successful Fluidity Testing 143
- FLEMINGS, D. — The Controlled-Slag Hot-Blast Cupola .. 113
- FLEMINGS, M. C., H. F. TAYLOR and C. M. ADAMS, JR. — Solidification and Riser of Gray Iron Castings 369
- FLEMINGS, M. C., H. F. TAYLOR and E. M. PASSMORE — Fundamental Studies on Effects of Solution Treatment, Iron Content and Chilling of Sand Cast Aluminum-Copper Alloy 96
- FLEMINGS, M. C., H. F. TAYLOR and S. Z. URAM — Effect of Pressure During Solidification on Microporosity in Aluminum Alloys 129
- FLEMINGS, M. C., R. W. STRACHAN, E. J. POIRIER and H. F. TAYLOR — Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses 336
- FLEMINGS, M. C., R. W. STRACHAN, E. J. POIRIER and H. F. TAYLOR — Rigging Design of High Strength Magnesium Alloy Castings 241
- FLINN, R. A. and C. R. MIELKE — Effects of Foundry Variables upon Porosity of 85-5-5-5 Bronze 391
- FLINN, R. A., G. A. COLLIGAN and L. H. VAN VLACK — The Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction 452
- GEARY, E. A. — Pattern Standards for Practical Foundry Usage 556
- GERTSMAN, S. L. and A. E. MURTON — A Literature Review of Metal Penetration 1
- GLASSENBERG, M., A. H. HESSE and W. H. BAER — Occurrence and Elimination of Leakage in a Gun Metal Casting 231
- GREEN, H. M., J. ZOTOS and P. J. AHEARN — Ductile High Strength Titanium Castings by Induction Melting .. 225

- GREEN, P. W. — Salt Bath Heat Treatment vs. Quench and Temper Standard and Pearlitic Malleable 507
- GREEN, R. D. — The Effect of Cooling Rate on the Grain Size of Magnesium Casting Alloys 380
- GREENLEE, R. H. — Steel Scrap Specifications for Duplexing Cupola White Iron 268
- GRIMSLEY, J. D. and I. J. FEINBERG — Tensile Properties of Microshrinkage-Graded AZ-63 Magnesium Alloy.... 409
- GROTT, G. J. — Particle Packing — Principles and Limitations 553
- HARE, A. W. and R. F. DICKERSON — A Method of Casting Radiator-type Fuel Elements for a Nuclear Reactor 210
- HARRIS, R. C. — Deoxidation Practice for Copper Shell-Molded Castings 69
- HEINE, R. W. — Hardenability of Pearlitic Malleable Iron 12
- HEINE, R. W. — Observations on Pinhole Defects in White Iron Castings 31
- HEINE, R. W., E. H. KING and J. S. SCHUMACHER — Correlation of Green Strength, Dry Strength and Mold Hardness of Molding Sands 59
- HEINE, R. W., E. H. KING and J. S. SCHUMACHER — The Problem of Hot Molding Sands 261
- HEINE, R. W. and T. W. SEATON — Density of Sand Grain Fractions of the AFS Sieve Analysis 40
- HESSE, A. H., W. H. BAER and M. GLASSENBERG — Occurrence and Elimination of Leakage in a Gun Metal Casting 231
- HLINKA, J. W. and V. PASCHKIS — Some Remarks on the Relationship of Interface Temperature and Solidification 213
- HOFMANN, F. — Investigations on the Effect of Heat on the Bonding Properties of Various Bentonites 305
- HORIGOME, T., I. IGARASHI, G. OHIRA, and K. IKAWA — Formation of Undercooled Graphite in Cast Iron... 561
- HOUSE, J. G. and M. E. BROCKS — Induction Melting in a Magnesium Sand Foundry 87
- HOWARD V. J. — Improving Electric Furnace Refractory Life by Special Shell Cooling Techniques 46
- HOWELLS, N. C., A. BUKOWSKI and E. A. LANGE — Cast Age-Hardenable Austenitic Steels 519
- HUELSEN, W. — Establishing an Effective Preventive Maintenance Program 439
- IGARASHI, I., G. OHIRA, K. IKAWA and T. HORIGOME — Formation of Undercooled Graphite in Cast Iron .. 561
- IKAWA, K., T. HORIGOME, I. IGARASHI and G. OHIRA — Formation of Undercooled Graphite in Cast Iron 561
- IKAWA, K. and G. OHIRA — Formation of Ferrite and Pearlite in Cast Iron 526
- JOHNSON, O. E. — The Use of Oil-Bentone Sand for Higher Quality Finish in Brass and Bronze Castings 415
- KANN, W. L., JR. and N. H. KEYSER — The Effect of Size of Scrap on the Tapping Temperature of a Cupola .. 397
- KARNOWSKY, M. — An Improved Design for Cast Tensile Bar Molds 284
- KEENAN, R. M. — Practical Application of the Work Sampling Technique 578
- KEYSER, N. H. and W. L. KANN, JR. — The Effect of Size of Scrap on the Tapping Temperature of a Cupola .. 397
- KIDNEY, D. C. — Gating and Rising Shell-Mold Pattern Equipment 312
- KING, E. H., J. S. SCHUMACHER and R. W. HEINE — Correlation of Green Strength, Dry Strength and Mold Hardness of Molding Sands 59
- KING, E. H., J. S. SCHUMACHER and R. W. HEINE — The Problem of Hot Molding Sands 261
- LAFORET, H. A. and F. J. WEBBERE — Duplexing Pays at Automotive Foundry 503
- LANGE, E. A., N. C. HOWELLS and A. BUKOWSKI — Cast Age-Hardenable Austenitic Steels 519
- LANGE, E. A. and R. E. MOREY — Sodium Silicates for the CO₂ Process 315
- LEMASTER, R. — A Little Knowledge of Plastics 197
- LYSOBEY, W. R. and A. E. TULL — Foundry Applications of the Calcium Carbide Injection Process 327
- MCQUISTON, C. E. and J. B. CAINE — The Theoretical Concepts of the Packing of Small Particles 36
- MAREK, C. T. and C. B. WARD — Gas Pressures in Green Sand Mold 361
- MICHALOWSKI, C., J. PARISI and O. C. NUTTER — Sieve Ratios and Processing for Strong Molding Sands 278
- MIELKE, C. R. and R. A. FLINN — Effects of Foundry Variables upon Porosity of 85-5-5-5 Bronze 391
- MOEHLING, J. P. — Aluminum Melting Practice in the Die Casting and Permanent Mold Fields 533
- MOREY, R. E. and E. A. LANGE — Sodium Silicates for the CO₂ Process 315
- MORGENSTERN, D. — Progress in Vacuum Die Casting... 199
- MURPHY, A. H., L. L. CLARK and W. ROSTCKER — Improvement of Castings by Press Forging 105
- MURTON, A. E. and S. L. GERTSMAN — A Literature Review of Metal Penetration 1
- NELSON, B. J. — Effect of Impurities upon the Resistance of Magnesium Casting Alloys AZ92 and AZ63 to Corrosion 544
- NESTOR, G. — Carbon Dioxide Cores in a Malleable Foundry 252
- NORMAN, T. E. — Factors Influencing the Resistance of Steel Castings to High Stress Abrasion 187
- NORTON, J. T., R. E. EDELMAN and H. W. ANTES — Foundry Characteristics of a Rammed Graphitic Mold Material for Casting Titanium 135
- NUTTER, O. C., C. MICHALOWSKI and J. PARISI — Sieve Ratios and Processing for Strong Molding Sands 278
- OHIRA, G. and K. IKAWA — Formation of Ferrite and Pearlite in Cast Iron 526
- OHIRA, G., K. IKAWA, T. HORIGOME and I. IGARASHI — Formation of Undercooled Graphite in Cast Iron 561
- ORTGIES, R. C. — Dust Piping Modifications to Prevent Material Buildup and Wear 418
- ORTIZ, J. A. and H. H. FAIRFIELD — Some Factors Affecting the Toughness of Mild Steel Castings 344
- OTTO, G. — Experiences in Nonferrous Die Casting Die and Permanent Mold Life 184
- PAL, A. and H. M. DAVIS — On the Release of Hydrogen from Molten Aluminum 301
- PARISI, J., O. C. NUTTER and C. MICHALOWSKI — Sieve Ratios and Processing for Strong Molding Sands 278
- PARKER, R. B. — Creating a Climate for Management Development 399
- PARLANTI, C. A. and R. V. VENEKLASEN — The Parlanti Mould Process for the Casting of Metal by Controlled Rate of Heat Transfer 177
- PASCHKIS, V. and J. W. HLINKA — Some Remarks on the Relationship of Interface Temperature and Solidification 213
- PASSMORE, E. M., M. C. FLEMINGS and H. F. TAYLOR — Fundamental Studies on Effects of Solution Treatment, Iron Content and Chilling of Sand Cast Aluminum-Copper Alloy 96
- PEDICINI, L. J. — Packing Characteristics of Typical Foundry Sands 421
- PIERCE, W. B., L. H. VAN VLACK and R. G. WELLS — Reduction of Silica in Large Shell Molds 459
- POIRIER, E. J., H. F. TAYLOR, M. C. FLEMINGS and R. W. STRACHAN — Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses 336
- POIRIER, E. J., H. F. TAYLOR, M. C. FLEMINGS and R. W. STRACHAN — Rigging Design of High Strength Magnesium Alloy Castings 241

POWELL, R. G. and H. F. TAYLOR—Shell Molding for Steel Castings	403	TAYLOR, H. F. and R. G. POWELL—Shell Molding for Steel Castings	403
PRUSSIN, S. A. and G. R. FITTERER—Some Requirements for Successful Fluidity Testing	143	TAYLOR, H. F., S. Z. URAM and M. C. FLEMINGS—Effect of Pressure During Solidification on Microporosity in Aluminum Alloys	129
PULSIFER, V.—Some Structural Considerations in Nodular Iron	56	TAYLOR, H. F. and D. W. G. WHITE—The Effect of Some Gases on the Work of Adhesion Between a Novolak and Quartz	288
QUIGLEY, F. C. and B. BOVARNICK—Sintered Alumina Molds for Investment Casting of Steels	247	TOTE, L. D. and R. S. ZENO—The Effect of Vanadium on the High and Low Temperature Mechanical Properties of a 1Cr-1Mo Cast Steel	425
RABE, R. A.—Study of High Temperature Properties of Shell Molds	484	TRUCKENMILLER, W. C., C. R. BAKER and G. H. BASCOM—Evaluation of Shell Molding Process Capability ..	81
REHDER, J. E. and J. E. WILSON—Annealing of Malleable Iron: Effect of Repeated Annealing on Rate of Second Stage Graphitization	387	TULL, A. E. and W. R. LYSOBEY—Foundry Application of the Calcium Carbide Injection Process	327
REMMERS, W. E.—Silicon: Present and Future	513	URAM, S. Z., M. C. FLEMINGS and H. F. TAYLOR—Effect of Pressure during Solidification on Microporosity in Aluminum Alloys	129
REDA, R. B. and W. M. ZEUNIK—Ladle Heating in the Foundry	349	VAN VLACK, L. H., R. A. FLINN and G. A. COLLIGAN—The Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction	452
RIBAR, G. P. and F. J. DOST—Prevention by the Ounce	433	VAN VLACK, L. H., R. G. WELLS and W. B. PIERCE—Reduction of Silica in Large Shell Molds	459
ROBERTS, D. and E. E. WOODLIFF—Mold Surface Behavior	74	VENEKLAEN, R. D. and C. A. PARLANTI—The Parlanti Mould Process for the Casting of Metal by Controlled Rate of Heat Transfer	177
ROSTOKER, W., A. H. MURPHY and L. L. CLARK—Improvement of Castings by Press Forging	105	VOGEL, E. G.—Purchase Specifications for Commonly used Steel Foundry Mold and Core Sand Binders	125
RUDDLE, R. W.—The Chemical Treatment of Copper Alloys	271	WALLACE, J. F. and E. B. EVANS—Rising of Gray Iron Castings	49
RUTEMILLER, H. C.—New Aluminum-Magnesium-Zinc Casting Alloy	222	WALSH, E. L.—Noise Induced Hearing Loss	324
SCALCO, R. V. and M. V. DAVIS—Foundry Practice for Sand Casting Commercially Pure Aluminum	238	WARD, C. B. and C. T. MAREK—Gas Pressures in Green Sand Mold	361
SCHALLER, G. S. and W. A. SNYDER—Industrial Applications of Olivine Aggregate	295	WEBBERE, F. J. and H. A. LAFORET—Duplexing Pays at Automotive Foundry	503
SCHUMACHER, J. S., R. W. HEINE and E. H. KING—Correlation of Green Strength, Dry Strength and Mold Hardness of Molding Sands	59	WELLS, R. G., W. B. PIERCE and L. H. VAN VLACK—Reduction of Silica in Large Shell Molds	459
SCHUMACHER, J. S., R. W. HEINE and E. H. KING—The Problem of Hot Molding Sands	261	WHITE, D. W. G. and H. F. TAYLOR—The Effect of Some Gases on the Work of Adhesion Between a Novolak and Quartz	288
SCHWABE, W. E.—The Electric Arc in Melting Furnaces	571	WILSON, J. E. and J. E. REHDER—Annealing of Malleable Iron: Effect of Repeated Annealing on Rate of Second Stage Graphitization	387
SEATON, T. W. and R. W. HEINE—Density of Sand Grain Fractions of the AFS Sieve Analysis	40	WOOD, F. W., S. L. AUSMUS and E. D. CALVERT—A Casting Technology for Reactive Metals	354
SHELL MOLD and CORE COMMITTEE (8-N)—Shell Molding Survey	559	WOODLIFF, E. E. and D. ROBERTS—Mold Surface Behavior	74
SMITH, L. W. L. and J. V. DAWSON—Gases in Cast Iron with Special Reference to Pickup of Hydrogen in Sand Molds	17	WRIGHT, W. A.—Construction of Shell Mold Patterns and Core Boxes	495
SNYDER, W. A. and G. S. SCHALLER—Industrial Applications of Olivine Aggregate	295	WULFF, C. E.—Investigation of the Hardening of Sodium Silicate Bonded Sand	91
STRACHAN, R. W., E. J. POIRIER, H. F. TAYLOR and M. C. FLEMINGS—Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses	336	ZANG, V. E.—Construction Hints and Wear Characteristics of Plastic Patterns and Core Boxes	569
STRACHAN, R. W., E. J. POIRIER, H. F. TAYLOR and M. C. FLEMINGS—Rigging Design of High Strength Magnesium Alloy Castings	241	ZENO, R. S. and L. D. TOTE—The Effect of Vanadium on the High and Low Temperature Mechanical Properties of a 1Cr-1Mo Cast Steel	425
TAYLOR, H. F., C. M. ADAMS, JR. and M. C. FLEMINGS—Solidification and Rising of Gray Iron Castings	369	ZEUNIK, W. M. and R. B. REDA—Ladle Heating in the Foundry	349
TAYLOR, H. F., M. C. FLEMINGS, R. W. STRACHAN and E. J. POIRIER—Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses	336	ZOTOS, J., P. J. AHEARN and H. M. GREEN—Ductile High Strength Titanium Castings by Induction Melting ..	225
TAYLOR, H. F., M. C. FLEMINGS, R. W. STRACHAN and E. J. POIRIER—Rigging Design of High Strength Magnesium Alloy Castings	241		
TAYLOR, H. F., E. M. PASSMORE and M. C. FLEMINGS—Fundamental Studies on Effects of Solution Treatment, Iron Content and Chilling of Sand Cast Aluminum-Copper Alloy	96		

SUBJECT INDEX

A

Abrasion
 High stress, steel castings
 resistance to187-196

Additions
 Aluminum17, 18, 20, 34
 Ammonium compounds 17
 Argon gas18, 20
 Bentonites1, 9, 10, 11
 Bismuth19, 564, 566
 Carbon6, 17, 18
 Carbon dioxide gas 18
 Cereal1, 10
 Coal dust19, 27
 Copper544
 Core oil 1
 Deoxidizer 17
 Ferro-cyanides 17
 Ferro-silicons 24
 Fire clay1, 11
 Fused salt 1
 Iron547
 Magnesium 24
 Manganese16, 19, 20, 563
 Nickel544
 Nitrogen 17
 Oxygen564
 Pitch10, 19, 27
 Sea Coal 10
 Selenium564
 Silica flour1, 10, 11
 Silicon16, 544, 563
 Sodium silicates315-323
 Sulfur564
 Tellurium19, 564
 Titanium 16
 Wood flour10, 11, 27
 Vanadium425-432

Adhesion
 Ammonia effect291-293
 Between a novolak and quartz,
 gases effect on288-294
 Nitrogen effect291-293
 Oxygen effect291, 292
 Water vapor effect291-293
 Work of288

Age Hardening
 Austenitic steels519-525

Aggregate
 Olivine, industrial
 applications295-300

Aging Practices
 And properties, aluminum
 alloy X357480-483

Air Quench
 Hardenability curves13, 14

Alloy
 Aluminum129-134
 Aluminum-magnesium-zinc,
 new222-224
 Aluminum, melting practice ..497-502

Alloy (continued)
 Aluminum, X357, properties and
 aging practices480-483
 Magnesium, AZ-63, tensile
 properties409-414
 Magnesium castings,
 rigging design241-246
 Magnesium, impurities effect on
 corrosion resistance544-552
 Magnesium, sand castings,
 chill performance336-343

Alloys, Copper
 Chemical treatment271-277

Alumina Molds
 Sintered, investment casting
 steels247-251

Aluminum
 And ferrosilicon, pinholing effect .. 24
 Briquette-treated melts302
 Castings, mechanical properties ..178
 Chill depth, effect on 18
 Chilling effect, molten534
 Eliminates pinholes 34
 Experimental melting stock ..301-302
 Forms of porosity301
 Furnaces for melting534-542
 Gas absorption534
 Gas vs. electric furnaces542
 Heat content539
 Hydrogen effect534
 Increase in use533
 Iron absorption534
 Layer density, cylindrical castings .302
 Magnesium content vs.
 test metal303
 Magnesium-zinc casting alloy .222-224
 Mean density vs.
 mold temperature304
 Melting practice, die casting and
 permanent mold533
 Molten, hydrogen release from
301-304
 Nitrogen and chlorine fluxing ...534
 Pinholing, effect on20, 22, 23
 Porosity causes539
 Still bath vs. stirring action ..542-543

Aluminum Alloy
 Aging graphs481, 482
 Applied pressure, effect of 133
 Artificial aging480, 481
 Average aging properties483
 Average brinell hardness483
 Casting temperatures used481
 Degassing techniques129
 Fluxing500, 501
 Furnace melting equipment ..497-498
 Grain refining501, 502
 Heat treating and testing131
 Holding furnace equipment498
 Hydrogen effect133
 Hydrogen vs. porosity,
 equations134

Aluminum Alloy (continued)
 Hydrostatic pressure129, 131
 Ingot analysis481
 Inherent characteristics of497
 Inventory control499
 Mechanical properties vs.
 various pressures 133
 Melting, pouring, solidification
 practice130, 497-502
 Metal cleanliness498, 499
 Microporosity vs. mechanical
 properties129
 Microradiographs132, 133
 Modification502
 Nature of solidification129
 Radiographs131, 132
 Sludging499
 Solidification pressure vs.
 microporosity129-134
 Solution heat treatments481
 Technique for melting,
 importance497
 Temperature control499

Aluminum Castings
 Annealing240
 Application of238
 Chemical composition239
 Commercially pure,
 sand casting238-240
 Factors influencing238
 Fluxing of melt239
 Gating and risering239, 240
 Mechanical and electrical
 properties178, 240
 Melting and pouring practice ...239
 Sand practice240
 Sawing and grinding240
 Shakeout240
 Shrinkage allowance240

Aluminum-Copper
 Chemical analyses,
 experimental heats 97
 Solution treatment, iron content
 and chilling effect96-103

Annealability
 vs. oxygen, malleable iron 18

Annealing
 Of malleable iron387-390
 Rate of389
 Repeated, effect, second stage
 graphitization387-390

Arc, Electric (see also Electric Arc)
 In melting furnaces571-577

Austenitic
 Gray iron risering 50
 High manganese cast iron,
 hydrogen pickup 19

Austenitic Steel
 Age-hardening519-525
 Alloys used for tests520-522, 525
 Cr-Mn522, 525

Austenitic Steel (continued)	
Cr-Mn-Ni-V	522-523, 525
Cr-Ni-P	520-522, 525
Mn-V	523-524, 525
Chemical composition of four types	520
Machinability	525
Nominal analyses-master alloys ..	519
Sand mixtures for	520
Solidification characteristics ..	524-525
Solidus temperature vs. composition factor	525
Austenitizing	
Pearlitic malleable, raises hardenability	12

B

Bar Molds	
Cast, tensile, improved design	284-287
Cavity flow, percentage	285, 287
Evaluation basis	284, 285
Flow uniformity	287
Ingates	287
Bentonite	
Additions vs. hot deformation	9, 10, 11
Base exchange capacity	305
Correct temper moisture content ..	306
Determination of bonding capacity	306
Differential thermal analysis	306, 307, 309, 310, 311
Dry strength vs. heating temperature	307, 308, 310, 311
Green strength vs. heating temperature	307, 308, 309, 310
Heat effect on bonding properties	305-311
Heat treatment effect on bonding	306
Properties with water	307, 308
Soda addition	305
Temper moisture content vs. heating temperature	308
Western-type	305
Western vs. southern	307, 308
Bibliography	
Aluminum alloy melting practice	502
Aluminum-copper alloy	103
Aluminum-magnesium-zinc casting alloy	224
Bronze, 85-5-5-5, porosity, foundry variables effect	396
Cast iron, undercooled graphite formation	568
Controlled-slag hot-blast cupola ..	124
Copper alloys treatment	227
Factors affecting steel castings ..	348
Fluidity testing	149
Gases effect on adhesion	294
Gases in cast iron	29-30
Graphitic molds for titanium	142
Gray iron risering	55
Heat effect on bentonite	311
High strength titanium castings ..	230
High stress abrasion, steel castings	196
Hydrogen in molten aluminum	304
Iron-Silica interface reaction	458
Magnesium alloys, cooling rate effect on grain size	386
Metal penetration	6
Microporosity in aluminum alloys	134
Mol gas pressure	367

Bibliography (continued)	
Molding sand sieve ratios	283
Nodular iron ferritization	165
Reactive metal castings	360
Sand grain fraction density	45
Shell molded copper castings	73
Silica reduction in shell molds	464
Sintered alumina molds, investment casting	251
Solidification and risering gray iron	379
Theories of small particle compaction	39
Vanadium effect on a cast steel	423
Binders	
Steel mold and core sand, purchase specifications	125-128
Bonded Sand	
Atmosphere effect	93
Carbon dioxide hardening	91, 92
Chemical hardening	93
Core deterioration	93, 94, 95
Gassing time vs. tensile strength	91, 92
Hardening methods	91, 95
Sodium silicate, hardening	91-95
Temperature effect	94
Testing materials	91
Thermal hardening	92, 93, 94, 95
Time effect	93, 94
Water evaporation hardening	92
Bonding	
Properties, bentonite, heat effect	305-311
Brass	
And bronze castings, oil-bentone sand use	415-417
Bronze	
And brass castings, oil-bentone sand use	415-417
Centerline porosity	396
Chills, effect of	394-396
Complete	394, 395
Partial	395, 396
85-5-5-5, foundry variables effect on porosity	391-396
Factors governing porosity	391
Leak rates	392, 393
Melting and pouring practice	391
Moisture content of sand	393, 394
Molding practice	391
Pouring temperature	392
Pressure testing	391, 392
Temperature data, leakage	392
Dry sand	392
Geometrical distribution	392
Green sand	392

C

Calcium Carbide Injection	
Brinnell hardness vs. section size ..	334
Case histories	329-332
Chill vs. microstructures	333, 334
Equipment for	327, 328
Induction melting	335
Physical properties	333, 335
Principles of	327
Process, applications of	327-335
Carbon	
Content vs. metal penetration	1
Losses in cast iron	18
Carbon Dioxide	
Amount required to attain viscosity	320
And air mixtures	323
Concentration and flow rate vs. gassing time	323

Carbon Dioxide (continued)	
Decreases hydrogen content	18
Gassed strength	318
Process, chemistry of	315-317
Process, sodium silicates for ..	315-323
Carbon Dioxide Cores	
Casting surface	253
Chemical analysis, molasses used ..	252
Comparison, carbon dioxide and core oil sand	253
Core collapsibility	256
Gassed properties	252, 253
Gassing time vs. core storage life ..	254
Green compressive strength	252
In a malleable foundry	252-256
Sand sieve analysis	253
Sand temperature core weight relationship	254
Sand temperature vs. core storage life	254
Sand temperature vs. tensile strengths	254
Sodium silicate sand mix	253, 256
Temperature-hardness relationship	255
Casting	
Aluminum, foundry practice	238-240
Die and permanent mold, nonferrous	184-186
Gun-metal, occurrence and elimination of leakage	231-237
Investment, sintered alumina molds	247-251
Metal, by controlled heat transfer	177-183
Nuclear reactor fuel elements, radiator type	210-212
Reactive metals	257-260
Technology, reactive metals	354-360
Castings	
Improvement by press forging	105-112
Magnesium alloy, chill performance	336-343
Magnesium, rigging design	241-246
Shell-molded, copper	69-73
Steel, factors affecting toughness	344-348
Steel, resistance to high stress abrasion	187-196
Titanium, high strength	225-230
Titanium, rammed graphitic mold materials	135-142
Cast Iron	
Areal ratios, ferrite to pearlite, manganese added	527
Base compositions and mechanical properties, test irons	203, 204
Carbon content and graphite structure	561-563
Eutectiform graphite and spherulite	207, 209
Graphite, decomposed, in end-chilled pig iron	565-566
Ferrite and pearlite formation	526-532
Ferrite and pearlite formation in spheroidal graphite	530-531
Ferrite of alloys melted, manganese added	527
Ferrite vs. tin content	531
Formation mechanism, ferrite and pearlite	526
Gases in, effect	17-30
Graphite classification	207

- Cast Iron (continued)**
 Graphite structure, additions
 effect563-565, 566
 Hydrogen effect17, 18, 19
 Hydrogen pickup, sand mold ..19-28
 Hypereutectic iron209
 Hypoeutectic iron209
 Ledeburite decomposition on
 heating567, 568
 Magnesium content and graphite
 forms in203-209
 Magnesium content vs.
 elongation205
 Magnesium content vs.
 tensile strength203
 Magnesium content vs.
 yield strength203
 Magnesium effect on graphite
 structure205
 Manganese effect on
 structure526-527
 Nitrogen effect17
 Oxygen effect17
 Pearlitic malleable
 hardenability12-16
 Pearlite matrix formation528
 Pearlite matrix with acicular
 cementite formation527-528
 Phosphorus and tin effect
 on matrix530
 Pinholing19-29
 Aluminum effect ..20, 23, 24, 25
 Appearance of19
 Ferrosilicon effect24, 25
 Hydrogen content effect26
 Magnesium effect24, 26
 Manganese effect20, 22
 Minimized19
 Other elements effect26
 Prevention of19
 Pouring temperature effect28
 Titanium effect21, 23, 26, 27
 Shell molded459
 Structure of526
 Undercooled graphite
 formation18, 561-568
- Cast Steel**
 Chemical composition, test blocks.425
 Energy and fracture appearance
 graphs429
 Heat treatments used, and hardness
 results426
 Low alloy425
 Mechanical properties, vanadium
 effect425-432
 Parameter creep data432
 Parameter rupture data430, 431
 Room temperature tensile results.428
 V-notch charpy impact429, 430
 X-ray results428
- Cereal**
 Additions vs. hot deformation10
- Charpy**
 Impact tests153, 162, 163, 429
- Chemical Composition**
 Cast steel test blocks425
 Hardenability, pearlitic malleable .12
- Chemical Treatment**
 Charcoal in melt, effect271
 Copper alloys271-277
 Flux vs. soundness and tensile
 properties275
 Gas content assessment277
 Gas removal, hydrogen273
 Grain refinement277
 Hydrogen, oxygen equilibrium
 in molten copper274
 Melting fluxes271, 272
- Chemical Treatment (continued)**
 Melting treatments vs. metal loss ..272
 Prevention of compound gas
 unsoundness273
 Oxidation-reduction
 treatment274, 275, 276
 Residual phosphorous vs.
 porosity275
 Solubility of hydrogen in
 copper alloys273
- Chilling**
 Aluminum-copper alloy, effect .96-103
- Committee and Research Reports**
 Basic Concepts Committee
 (8-V)40, 553
 Brass and Bronze Research Com-
 mittee (3-C)391
 Controlled Annealing Committee
 (6-D)166
 Gray Iron Division Research49
 Pearlitic Malleable Committee
 (6-E)12
 Shell Mold and Core Committee
 (8-N)599
 Shell Molding Committee (8-N) ..484
- Compaction**
 Blending natural deposits554
 Configurations37
 Cubic packing37
 Orthorhombic packing37
 Crushed material, use of553-554
 Density vs. GFN422
 Distribution changes, density38
 Green compressive strength vs.
 density at different ramming
 levels422
 Green properties, bonded ..423, 424
 Largest particle size effect on
 density38
 Nonuniform particles37
 Of small particles, theories36-39
 Ottawa Sand554
 Permeability vs. GFN423
 Principles and limitations553-555
 Properties at 10 psi green com-
 pressive strength424
 Radius ratios39
 Rammed density, bonded ..422, 423
 Rammed density, dry421, 422
 Sieve analysis of tested
 sands422, 555
 Spherical particles36
 Theoretical densities37, 38
 Uniform particles36, 37
- Cooling Rate**
 Effect on grain-size, magnesium
 alloys380-386
 Vs. ferrite formation, nodular
 iron154, 155
- Copper**
 Alloys, chemical treatment ..271-277
 Shell-molded castings69-73
- Core Boxes**
 And patterns, shell mold, con-
 struction495-496
 Wear and construction, plastic
 patterns and569-570
- Cores**
 Carbon dioxide, malleable
 foundry252-256
 Metal penetration in sand1
- Corrosion**
 Resistance, magnesium alloy,
 impurities effect544-552
- Cupola**
 Blast temperature14
 Blast velocity vs. metal tempera-
 ture118, 119
- Cupola (continued)**
 Cleaning system114
 Coke charge used, scrap397
 Conical design118, 119
 Controlled-slag hot-blast113-124
 Heat loss119
 Heat sources vs. heat dissipation ..123
 Hot-blast system114
 Inferior fuels122
 Melting rate vs. heat loss121
 Metal analysis change117
 Metal charges used, scrap397
 Operation, scrap effect397
 Recuperative system114
 Recuperator installation114, 115
 Automatic control equipment ..115
 Blast temperature amplifier ...115
 Pressure element115
 Refractory lining contour117, 118
 Size limitation121, 122
 Slag117, 119, 120, 123
 Chemistry and silicon content
 vs. metal temperature123
 Tapping temperature, scrap
 size effect397-398
 Temperature control117
 The cupola proper115, 116, 117
 Internal conditions116
 Silica116
 Tuyere cooling vs. heat loss121
 White iron duplexing, steel scrap
 specifications268-270
- D**
- Decarburization**
 Lowers metal penetration6
- Density**
 Of sand grain fractions, sieve
 analysis40-45
- Deoxidation**
 Copper shell-molded castings ..69-73
- Design**
 Improved, cast tensile bar
 molds284-287
 Rigging, magnesium alloy
 castings241-246
- Die Casting**
 Aluminum185
 And permanent mold, aluminum
 melting practice533-543
 Cold chamber process201
 Die welding repair185
 Draft vs. soldering185
 Entrapped air problem199
 Hot chamber process199
 Mold coating and lubricants,
 effect185
 Temperature vs. die life186
 Vacuum, benefits200
 Vacuum, progress in199-202
 Water spraying, effect185
- Duplexing**
 Advantages503, 504
 Benefits503-504, 506
 Chill control with505
 Composition control with505
 Cupola white iron, steel scrap
 specifications268-270
 Disadvantages of506
 In automotive foundry503-506
 Increased productivity506
 Plant arrangement for504
 Scrap reduction with505
 Temperature control with505
- Dust Piping**
 Modifications, to prevent material
 buildup and wear418-420
 Ventilation418-420

Dust Piping (continued)

Aerator	419
Elbow	418
Elevator	420
Rotary screen	420
Sand bin	420
Sand mixer	419

E

Electric Arc

Characteristics of	575
Classification of	571
Dynamic characteristics	576
Electrodes for	576-577
Energy distribution of	573
External forces effect	574-575
Ignition of	572
In melting furnaces	571-577
Mechanical forces in	573
Melt-surface depression	574
Pinch effect	573-574
Potential distribution	572-573
Split	572
Static characteristics	575
Utilization of power in	576

Electric Furnace

Arc	571-577
Electrode coolers	46, 47
Equipment used	46
Gland	46, 47
Refractory shell cooling techniques	46-48
Refractory thickness	47
Ring coolers	46, 47
Shell cooler	47, 48

End Quench

Hardenability curves	12, 13, 14, 15, 16
----------------------------	--------------------

F

Ferrite

And pearlite formation, cast iron	526-532
Formation vs. cooling rates, nodular iron	154, 155

Fire Clay

Additions vs. hot deformation ..	10, 11
Bonded sands	7

Fluidity Testing

Calculation, dimensions, plant reservoir fluidimeter	149, 150
Fluidimeter	143
Fluidimeter mold	144, 145, 146
Flow cessation mechanism	147
Mechanism control	148
Method of measuring	143
Slag and metal flow	144
Some requirements for	143-150
Steel flow, curves	144
Temperature vs. fluidity in zinc	147, 148
Variables	143

Foundry

Application, calcium carbide injection process	327-335
Automotive, duplexing	503-506
Induction melting, magnesium ..	87-90
Ladle heating	349-353
Malleable, carbon dioxide cores in	252-256
Pattern standards	556-558
Practice, sand casting aluminum	238-240
Purchase specifications, steel mold and core sand binders	125-128

Foundry (continued)

Sand, packing characteristics ..	421-424
Variables effect on porosity, 85-5-5-5 bronze	391-396

G

Gases

Adhesion between a novolak and quartz effect	288-294
Equations for calculating effect ..	289
In cast iron	17-30
Pinholing effect	33, 34, 35
Strength of bond effect	288, 289

Gas Pressures

Batch properties	364
Blow-hole size	364
Changing zones in molds	361, 362
Compaction energy, equations	367, 368
Depth of sand vs. time	366
Experimental pressure data	368
Growth of zones, equations	366
In green sand mold	361-368
Moisture effect on mold gas pressure	365
Moisture effect on permeability ..	365
Mold-metal interface	361
Mold pressure	361, 366
Permeability	362, 363
Permeability effect, mold	365
Permeability, equations	367
Pressure measurement	362, 363, 364
Pressure vs. time	364
Sand conductivity, equations	367
Temperature measurement	363, 364
Time-temperature-distance from interface, relationship	365
Units of designation	368

Gating

And risering shell-mold pattern equipment	312-314
To prevent pinholing	33, 34, 35

Graphite

Forms and magnesium content, cast iron	203-209
Undercooled, formation, cast iron	561-568

Graphite Films

Formation	19
White Iron	19

Graphitization

First stage	387
Second stage, repeated annealing effect	387-390

Gray Iron (see also Malleable Iron, Nodular Iron, Pearlitic Malleable)

Atmospheric pressure effect ..	377, 378
Austenite dendrites	50
Behavior of riser variations ..	376-379
Constants values, solidification calculations	373
Dimensional and volume changes	376
Exothermic risers	378, 375
Equations, solidification and risering	374, 375
Eutectic cells	50
Factors governing shrinkage	371
Ferrositic pressures	372
Freezing temperature range	50
Good risering recommendations ..	54
Graphite flakes	50
Graphite precipitation	371
Heat evolved in cooling	375
Hypoeutectic	50
Importance of dilation	372
Inoculation of	50

Gray Iron (continued)

Iron-carbon-silicon system	373-374
Location of risers	53
Microporosity problems	50, 51
Molding and Riser conditions effect	371, 372
Mold materials effect on risering	50, 51, 52
Casting movement, solidification	51
Green and dry sand	50
Mold wall movement	50, 52
Shrinkage distribution	371, 372, 373
Volume changes, solidification	373, 374
Pearlitic malleable, hardenability	12-16
Phosphorus effect	50
Rate of solidification	374, 375
Research conclusions	369, 370, 371
Risening	49-55, 369-379
Riser neck selection	53-55
Dimensions	55
Recommendations	53, 54
Riser size selection	51-53
Dimensions	52
Equations for calculating	52
Liquid contraction	52
Variables	51, 52
Shrink behavior of a typical ..	375, 376
Solidification and risering ..	369-379
Solidification mechanism ..	49, 50, 51
Temperature vs. cooling time ..	376
Green Sand Mold, gas pressures in	361-368
Gun-Metal Casting Blind risers	234, 235
Chills	236, 237
Dimensions, sprue, runner, gates ..	234
Melting	232
Molding and core sand mixtures ..	233
Occurrence and elimination of leakage	231-237
Pressure testing	233
Sand properties	235
Tensile properties	235

H

Hardenability

Austenitizing raises	12
Chemical composition, test bars ..	12
Graphs	12, 13, 14, 15, 16
Iron with manganese and silicon ..	16
Normal range, pearlitic malleable ..	16
Pearlitic malleable	12-16
Testing, pearlitic malleable	12

Hardening

Sodium silicate bonded sand	91-95
-----------------------------------	-------

Hearing

Audiometric examination	326
Loss, noise induced	324-326

Heat Transfer

Controlled, process for casting	177-183
Limits metal penetration	2

Heat Treatment

Vs. quench and temper, standard and pearlitic malleable	507-512
---	---------

Hot-Blast Cupola

Controlled-slag, the	113-124
----------------------------	---------

Hot Deformation

Additions vs.	9
Bentonite blends vs.	10
Hot Compressive strength vs. ..	8, 9
Moisture vs.	9
Temperature vs.	8, 9

- Hot Deformation (continued)
 Ultimate hot deformation vs. 8
 Cushioning material to increase .. 7
 Equations for calculating 7
 Equipment for measuring 8
 Expression of 7
 Molding sands 7-11
 Rate of 7
- Hot Toughness
 Additions effect 10, 11
 At elevated temperatures 10, 11
 Meaning of 8
 Peaks 10, 11
 Sand 7
 Varies with bonds, additions, temperature 10
- Hoyt, Charles Edgar
 Memorial Lecture, Silicon:
 Present and Future 513
- Hydrogen
 Content raised, damp sand 19
 Factors affecting 29
 Flake-graphite iron, effect on 18
 Pickup from sand molds 19-28
 Pinholing effect 34
 Release from molten
 aluminum 301-304
 Solubility 29
 Titanium effect 18
- I**
- Impurities
 Magnesium alloys resistance to corrosion, effect of 544-552
- Induction Melting
 Ductile high strength titanium castings 225-230
 Flux consumption 89
 In magnesium sand foundry 87-90
 Labor needed 89
 Meltdown metal loss 89
- Injection
 Process, calcium carbide 327-335
- Inoculation, Gray iron 50
- Investment Casting
 Economic advantages 250, 251
 Melt out and firing cycle 249, 250
 Metal casting 250, 251
 Mold properties 247
 Slip and mold preparation 248, 249
 Steels, sintered alumina molds 247-251
 Wax patterns 247
- Iron, Cast
 Ferrite and pearlite formation 526-532
 Gases in 17-30
 Magnesium content and graphite forms in 203-209
 Undercooled graphite formation in 561-568
- Iron Content
 Aluminum copper alloy effect 98-103
- Iron, Gray
 Rising 49-55
- Iron, Malleable
 Annealing of 387-390
 Microstructures, effect and cause 166-176
- Iron, Nodular
 Ferritization 151-165
 Structural considerations 56-58
- Iron-Silica
 Interface reaction, atmosphere and temperature effect 452-458
- Iron, White
 Duplexing, cupola, steel scrap specifications 268-270
- L**
- Ladle Heating
 Aspirator-type burner 352, 353
 In the foundry 349-353
 Premixing burner 349, 350, 351, 352
 Temperature-time curves 350, 351, 352
- Leakage
 In gun-metal casting, occurrence and elimination 231-237
- Liquid Quench
 Pearlitic malleable, graphs 13, 14
- M**
- Machinability
 Pearlitic malleable 12
- Magnesium
 Content, and graphite forms, cast iron 203-209
 Pinholing effect 21, 23, 26, 27
 Vs. sulfur, nodular iron 58
 -Aluminum-zinc casting alloy 222-224
- Magnesium Alloy
 Acid dip test, AZ92
 Aluminum content, test specimen 410
 Chemical composition control 410
 Chrome-pickle treatment 544
 Composition limits, AZ92 and AZ63 544
 Composition, properties and corrosion losses 546-548
 Copper effect on AZ92 and AZ63 544, 547, 552
 Corrosion tests made, AZ92 and AZ63 545
 Determination of tensile properties 411-413
 Equations for 411-413
 Mean, and scatter 411
 Regression coefficient 411, 412
 Standard deviations 411
 Elongation minima 413
 Gradations in microshrinkage 410
 Impurities effect on corrosion resistance, AZ92 and AZ63 544-552
 Industrial atmosphere tests, AZ92 and AZ63 551
 Iron effect, AZ92 and AZ63 547
 Mean elongation 412
 Mean ultimate tensile strength 412
 Mean yield strength 412
 Nature of microshrinkage in 409, 410
 Nickel effect, AZ92 and AZ63 544-545, 547, 551-552
 Radiographic classification 411
 Radiographs for quality control 409, 410
 Salt peroxide spray tests, AZ92 and AZ63 545
 Salt spray tests, AZ92 and AZ63 545, 547
 Silicon effect, AZ92 and AZ63 544
 Tempering used for tests, AZ92 and AZ63 544
 Tensile tests, AZ92 and AZ63 544
 Types of microshrinkage 409
 Ultimate strength minima 413
 Yield strength minima 413
- Magnesium Castings (continued)
 Chemical control and melting practice 241, 242, 337
 Chills used 243
 Chilling vs. mechanical properties 341
 Chilling vs. tensile strength 241
 Cleaning and heat treatment 244
 Cooling range 382, 383
 Cooling rate vs. grain size 383-385
 End chills 338
 Foundry data large and small
 gimbals castings 242, 243
 Gating, risering, molding 337
 Grain refinement 337
 Grain sizes 339-340
 Heat treatment 337
 High strength sand castings, chill performance 336-343
 Markets for 336
 Mechanical properties 245, 246
 Chilled 337, 338, 339, 342
 Specifications 340, 341
 Metallographic examination 337, 338
 Microstructure rating 338
 Molding procedure, gimbals castings 242, 243, 244
 Rigging design 241-246, 341
 Solidification progress micrographs 381-384
 Spectroanalysis, test composition 380, 381
 Tensile properties 338
- Maintenance
 A matter of logic 439
 And mechanization 446
 Compressed air 438
 Cranes and hoists 437, 438
 Definition of 446
 Engineering for preventive 444
 Engineering standards and inspection follow-up 444, 445
 Fuel burning appliances 438
 In management 445
 Inspection frequency 441
 Material handling 436-437
 Belt and gravity conveyors 437
 Bucket elevator boot and clam-shell buckets 437
 Molding machines 437
 Self-propelled vehicles 436
 Towed or pushed vehicles 436, 437
 Melting equipment 438
 Per cent maintenance workers in plants 446
 Plan for preventive 441
 Plant department duties 433
 Power supply 433-434
 Prevention by the ounce 433-438
 Preventive, in foundry 446-451
 Program, establishing an effective 439-445
 Programs 447-449, 451
 Air cylinder 448
 Departmental 451
 Inspection 451
 Lubrication 447
 Truck 448, 449
 Records 443
 Utilities importance 439-441
 Utilization apparatus inspection and 434, 435, 436
 Electric motors 434
 Generator and rectifiers 435
 Heating 436
 Lifting magnets and magnetic pulleys 435, 436
 Lighting 436

- Maintenance (continued)**
- Magnetic brakes435
 - Motor controllers434, 435
 - Signals436
 - Visual record board443, 444
- Malleable Iron**
- Annealing rate389
 - Basic chemistry, standard and pearlitic507
 - Black heart387
 - Charge, typical, standard and pearlitic507
 - First stage graphitization387
 - Foundry, carbon dioxide cores in252-256
 - Hardness determinations389, 390
 - Hardness values, standard and pearlitic510
 - Holding time effect389
 - Mechanical properties, typical, standard and pearlitic507, 508, 510
 - Microstructures167-175
 - Microstructures, effect and cause166-176
 - Number of anneals vs. hardness and annealing rate388
 - Number of traverses vs. maximum cooling rate389
 - Oxygen vs. annealability18
 - Pearlite, hardenability12-16
 - Pinholing31
 - Repeated annealing effect, second stage graphitization387-390
 - Salt bath heat treatment510, 512
 - Slow-cool process387
 - Standard and pearlitic, heat treatment vs. quench and temper507-508, 510
 - Surface effects389, 390
 - Ways of eliminating pearlite, second stage graphitization387
 - White iron composition, test metal, annealing388
- Management**
- Broadening the experience of potential400
 - Development, creating a climate for399-402
 - Intangible qualities of good399
 - Job switching401, 402
 - Putting ideas into practice of potential400
 - Selection of candidates for399
 - Training program, a399
- Manganese**
- As pinholing cause19
 - Pinholing, effect on20, 22
 - In pearlitic malleable, hardenability16
- Melting, Induction**
- Ductile, high strength titanium castings225-230
 - Magnesium sand foundry87-90
- Melting Practice**
- Aluminum casting alloys497-502
 - Aluminum, die casting and permanent mold533-543
- Metal Casting**
- By controlled heat transfer ..177-183
 - Casting design183
 - Cooling rate, metal mold materials178
 - Copper alloys182
 - Cores180
 - Feed metal vs. physical properties, aluminum, effect179
- Metal Casting (continued)**
- High thermal conductivity, aluminum178
 - Light metals181
 - Mechanical properties, aluminum castings178
 - Permanent mold177
 - Process, effect of179
 - Risers effect177
 - Sand177
 - Steel182
 - Vacuum techniques182
- Metal Penetration**
- Alleviated by washes4
 - As a gas1
 - As an oxide1
 - Depth vs. pressure5
 - Elimination by core mixes6
 - In cores and molds1
 - Increases with metal head3
 - Increases with temperature3
 - Literature review1-6
 - Major causes1
 - Metal head effect4
 - Resistance4
 - Decreased with excessive ramming4
 - Increased with ramming4
 - Test castings used for metal ..1, 2, 3
- Metals**
- Nonferrous, die and permanent mold casting466-479
 - Reactive, casting257-260
 - Reactive, casting technology .354-360
- Microporosity**
- Problem, gray iron castings50, 51
 - Vs. solidification pressure, aluminum alloys129-134
- Microshrinkage**
- Graded AZ-63 magnesium alloy, tensile properties409-414
- Microstructures**
- Malleable iron, effect and cause166-176
- Moisture**
- Control to prevent pinholing33
 - Sand, hot deformation rate9
 - Vs. hydrogen content18
- Mold**
- Controls necessary76
 - Expansion graphs76-80
 - Metal penetration in sand1
 - Penetration for steel4
 - Rammed graphite material, titanium castings135-142
 - Rammed, movement74
 - Ramming vs. penetrating pressure 3
 - Rate of expansion, data77
 - Steel and core sand binders, purchase specifications125-128
 - Surface behavior74-80
 - Temperature ranges76
 - Thermal growth74
- Mold Hardness**
- Molding sands59-68
- Mold Materials**
- Rising, gray iron, effect50, 51
- Mold Process**
- Metal casting, by controlled heat transfer177-183
- Molding Sand (see also Sand)**
- Additions vs. hot deformation9, 10, 11
 - Additives effect, metal penetration 1
 - At elevated temperatures7
 - Bentonites vs. hot deformation9, 10, 11
 - Clay effect61, 62
- Molding Sand (continued)**
- Clay type equivalence64
 - Compressive hot strength7
 - Compressive load, rammed specimen7
 - Cooling hot sands263
 - Correlation, method of59, 60, 61
 - Cubical volume relationship280
 - Cubic packing279, 280
 - Cushioning material7
 - Developing properties in265
 - Dry compressive strength265, 266, 267
 - Dry strength and green strength combinations68
 - Dry strength vs. per cent of water 66
 - External load7
 - Fire clay63
 - Fool-proof sand280, 281
 - Green compressive strength265, 266, 267
 - Green strength, dry strength, mold hardness, correlation59-68
 - Green strength vs. dry strength .60-68
 - Hot deformation7-11
 - Hot toughness7, 8, 10, 11
 - Internal loading7
 - Inter-sand-grain movement7
 - Mixes7
 - Mixing and uniformity282
 - Moisture in sands263, 264
 - Moisture vs. hot deformation9
 - Mold hardness vs. green and dry strength60
 - Mold hardness vs. green strength61, 63-67
 - Mulling283
 - Effect262, 263
 - Time change, effect265-267
 - Time vs. green and dry strength265
 - Time vs. temperature and moisture262, 263
 - Time vs. temperature, moisture, green and dry strength262
 - To prevent pinholing33
 - Preparation283
 - Problem of hot261-267
 - Relative mesh-cube volumes280
 - Restraining loads7
 - Rhombohedral and Rhombic packing278, 279
 - Sand temperature vs. cooling during mulling265
 - Screen-size distribution278
 - Sieve ratios and processing for strong278-283
 - Silica sand expansion forces7
 - Southern bentonite63
 - Southern bentonite properties261
 - Steel casting sands7
 - Support balls estimation281
 - Thermal-static pressure7
 - Temperature vs. hot deformation 8, 9
 - Temperature vs. sand control properties261
 - Temperature vs. vapor pressure and heat of evaporation262
 - Water needed to cool264
 - Western bentonite62
 - Western bentonite properties261
- Molding, Shell**
- Copper castings69-73
 - Process capability evaluation ..81-86
 - Survey of559-560
- Molds, Alumina**
- Sintered, investment casting steels247-251

- Molds, Bar
Cast tensile, improved design .284-287
- Molds, Permanent (see also Die Casting)
And die life, nonferrous die casting .184-186
- Molds, sand
Green, gas pressures in .361-368
- Molten
Aluminum, hydrogen release .301-304
Penetrating pressure vs. surface tension .2, 6
- Mulling
Molding sand .33, 262-265, 283
- N**
- Nitrogen
Aluminum affinity to .17
As a carbide stabilizer .17
Content increased .17
By ammonium compounds .17
By ferrocyanides .17
In cast iron .17
Large additions, porosity .17
Pinholing effect .34
Retains eutectic carbide .17
Retains pearlite .17
Titanium affinity to .17
- Nodular Iron
Analysis .56
Austenitizing temperature .156
Cementite .151
Chemical composition, test irons .152
Composition .56
Ductility attainment .151
Elongation graphite .156
Eutectic fineness .57
Ferrite formation vs. cooling rates .154, 155
Ferrite zones .57
Fertitization .151-165
Of martensite .156, 157, 158
Of pearlite .155, 156
Graphite growth rate .57
Heat treatments .151, 152
Impact ductility, martensite .164
Impact tests .153, 162, 163
Values vs. unnotched bars .163
Interfacial energy .58
Isothermal growth .57
Isothermal transformation .158-162
Evaluation, treated reheated .163
For cooled specimens .158, 159
For reheated specimens .160, 161, 162
Magnesium vs. sulfur .58
Mechanical properties vs. per cent ferrite .155
Normalizing treatment omission effect .164
Per cent ferrite vs. time .155
Pinholing .19, 24
Properties, test irons .153
Quenching, fast .56
Quenching temperature vs. properties obtained .157
Secondary graphite .157
Shooting .56
Slow cool .57
Solidification mechanism .56
Structural considerations .56-58
Surface energy .58
Tensile properties vs. heat treatment .153, 154
Undercooling .56, 58
- Nodes
Formation, nodular iron .56-58
- Noise
Effects of .325, 326
- Noise (continued)
Induced hearing loss .324-326
What it is .324, 325
Why be interested in .325
- Nonferrous
Die casting, die and permanent mold life .184-186
- Nonferrous Metals
Alloys used, United Kingdom .468
- Pattern
Casting machines .469
Die and permanent mold casting, United Kingdom .466-479
Dies .469, 470
Fettling and finishing .472
Industrial standards, United Kingdom .472
Inspection and quality control .473
Mechanical handling .471
Mechanical properties, alloy .467
Melting equipment .468
Standard aluminum alloy .467, 468
Standard copper alloy .468, 473
Standard Magnesium alloy .468, 472
Standard zinc alloy .468, 473
Surface treatments .473, 474
Tensile and impact properties .476-479
Variation of properties with temperature .477
- Novolak
And quartz, adhesion between, gases effect on .288-294
- Nuclear Reactor Castings
Cores .211
Hexagonal castings .212
Melting and molding .210, 211
Mold design .210
Radiator type, fuel elements .210-212
- O**
- Olivine
Accurate castings from .299, 300
Aggregate, industrial applications .295-300
Gray iron applications .297, 298
Gray iron mixtures .298
High manganese-steel applications .298, 299
Nonferrous applications .296
Nonferrous sand formulations .296
Prior studies of .295, 296
Shell-molding applications .297
Shell-molding mixture .297
Steel applications .298
Steel mixtures, green sand .298
Thermal properties .296
- Oxygen
Chill depth, effect on .18
Content increase .17
In cast iron .17
Increase in ladle .17
Increase in low silicon iron .17
Stabilizing effect .17, 18
Vs. annealability .18
- P**
- Packing
Of small particles, theories .36-39
Particle, principles and limitations .553-555
- Particles
Packing, principles and limitations .553-555
Small, packing theories .36-39
- Pattern
Equipment, foundry .556-558
Equipment, shell mold, gating and risering .312-314
Margin of safety .557
- Pattern (continued)
Plastics, a little knowledge of .197-198
Shell mold, and core boxes, construction .495-496
Standards .556-558
Wear and construction, plastic core boxes and .569-570
- Patternmakers
Common problems of .36-39
Engineering problems of .585
How to help sell castings .583-586
Market factors .583
Pattern engineer and duties .584, 585-586
- Pearlite
And ferrite formation, cast iron .526-532
- Pearlitic Malleable
Air quench .13-14
And standard, heat treatment vs. quench and temper .507-512
Austenitizing increases
hardenability .12
Chemical composition .12
End quench .12-16
End quench graphs .13-16
Hardenability .12-16
Hardenability tests .12
Heat treatment .12
Liquid quench .13, 14
Machinability .12
Matrix hardness .15
Normal hardness range .16
Quench hardening .12
Rockwell hardness .12-15
- Penetration, Metal
Literature review of .1-6
- Permanent Mold
And die casting, aluminum melting practice .533-543
And die casting, nonferrous metals .466-479
And die life, nonferrous casting .184-186
- Pinholing
Additions effect .27
Aluminum effect .20, 23, 24, 25
Appearance of .19
Aspiration type .34
Gating against .34
Causes .31
Evolution type .34, 35
Ferro-silicon effect .24, 25
Hydrogen content effect .26
In white iron castings .31-35
Isolated type .35
Magnesium effect .24, 26
Manganese effect .20, 22
Pouring temperature effect .28
Prevention of .19
Reaction type .31, 32, 33
Titanium effect .21, 23, 26, 27
- Plastic
A little knowledge of .197-198
Early difficulties .197
Patterns and core boxes, construction and wear .569-570
Specification problems .198
Surface coat, pattern .569
Uses other than patterns .198
Upkeep, patterns and core boxes .570
Versatility and workability .197
- Porosity
85-5-5 bronze, foundry variables effect .391-396
- Press Forging
Aluminum alloys .105
- Pressure
Gas, in green sand molds .361-368

Pressure (continued)	
Increase promotes metal penetration	5
Solidification vs. microporosity, aluminum alloys	129-134
Prevention	
By the ounce	433-438
Establishing an effective maintenance program	439-445
Foundry preventive maintenance	446-451
Process	
Calcium carbide injection	327-335
Capability, shell molding, evaluation	81-86
Carbon dioxide, sodium silicates for	315-323
Processing	
And sieve ratios, strong molding sands	278-283
Properties	
And aging practice, aluminum alloy X357	480-483
Bonding, bentonites, heat effect	305-311
High temperature, shell molds	484-494
Mechanical, aluminum castings	178
Mechanical, cast steel, vanadium effect	425-432
Nodular iron	153, 154
Tensile vs. heat treatment	153, 154
Press forged magnesium castings	111
Tensile, AZ-63 magnesium alloy	409-414
Purchase Specifications	
Bentonite	127, 128
Cold set oil	126, 127
Core oil	126
Corn cereal	126
Inspection program	125
Liquid phenolic plastic	126
Shell mold and core sand binders	125-128
Tests and equipment used	125

Q

Quench Hardening, Pearlitic malleable iron	12
--	----

R

Rammed	
Graphitic mold materials, titanium castings	135-142
Ramming	
Vs. penetrating pressure	3
Reaction	
Iron-silica interface, atmosphere and temperature effect	452-458
Pinholes, white iron castings	31-33
Reactive Metal Casting	
Alloy casting effects	258, 259
Arc-current variation effect	328
Carbon analysis	360
Consumable-electrode arc furnace	354, 355, 358, 360
Corrosion rates, zircaloy	357
Gas porosity	257
Hafnium	356
Heat distribution and metal yield	358, 359
Heat loss, arc operation	359, 360
Machined graphite molds	355, 359
Method for	354, 355
Problems	257-260
Process variables	357
Sales problem	259, 260

Reactive Metal Casting (continued)	
Scrap utilization	259
Shrinkage and warping in baking molds	259
Spin casting	356
Technology for	354-360
Temperature controlling	257
Temperature, poured metal	358, 359
Thermopile device	257
Titanium	355, 356, 357
Vacuum-arc furnace	257
Variable alloy effect	358, 359
Variable ladle size effect	358, 359
Variable pressure effect	358
Variables vs. temperature of melt	257
Zircaloy	356, 357
Zirconium	357
Reduction	
Of silica, large shell molds	459-465
Refractory	
Cupola, lining contour	117, 118
Electric furnace, shell cooling techniques	46-48
Rigging	
Design, magnesium castings	241-246
Ring Coolers	
Electric furnace	46-48
Risening	
And gating, shell mold pattern equipment	312-314
Gray iron	49-55
And solidification	369-379
Location	53
Neck size selection	53, 54
Recommendations	53, 54
Size selection	51, 52

S

Sand (see also Molding Sand)	
Aluminum Castings	240
Bentonite additions vs. hot deformation	9
Base exchange capacity	305
Heat effect on bonding	305
Castings, aluminum	283
Aluminum-copper	96
Controlled heat transfer	177
Magnesium alloy	336
Compaction	36, 421, 553
Cores, CO ₂	252
Dry and green, effect on risering	50
Dry strength	59
Fire clay bonded	7
Grain fractions, density, sieve analysis	40
Grains, lose, pinholing	35
Green, gas pressures in molds	361
Green strength	59
Hot compressive strength	8
Hot deformation	7
Hot deformation vs. fire clay additions	10
Hot, problem of	261
Hot toughness	7
Hydrogen pickup from	19
Iron interface, freezing graphs	214
Magnesium foundry, induction melting	87
Metal penetration in, surface tension	290
Mixes, for steel casting	7
Mixtures, austenitic steels	520
Moisture, hot deformation rate	9
Mold	
Metal penetration in	1
Metal reaction	452
Ramming effect	3
Sand (continued)	
Surface behavior	74
Mulling of	33, 262, 283
Olivine, industrial applications	295
Properties, gun-metal castings	235
Shell mold, cold-coated mixes	492
Dry mixes	489
Mixtures	559
Size distribution	461
Uses, for tests	484
Sieve ratios for strong	278
Sodium silicate, for the CO ₂ process	315
Sodium silicate, hardening	91
Ventilation, bin and mixer	419
Voids, metal penetration	6
Sand, Compaction	
Small particles, theories	36-39
Sand Grain Fractions	
Compacting samples, method of	41, 42
Densities vs. jolting energy	43, 44
Density	40-45
Graphs, sand fractions	42, 43
Michigan bank	42
Michigan city	43
Ottawa	42
Wisconsin bank	43
Wisconsin silica	42
Iron determination	43
Microscopic examination	43
Ramming effects	42, 44
Sieve analysis	40, 41
Sieve fractions preparation	40, 42
Test sands used	40
Sand Grains	
Loose, pinholing	35
Sand Mixes	
Large steel castings	7
Sand Mold	
Green, gas pressures in	361-368
Hydrogen pickup, green and dry sand	19
Scrap	
Cupola operation, effect on	397
Metal charges used	397
Size and weight effect, tapping temperature and coke cost	398
Size effect, cupola tapping temperature	397-398
Types of, used	397, 398
Sea Coal	
Additions vs. hot deformation	10
Shell Mold	
Basic materials used	495
Casting defects	488
Casting diameter measurement	487
Cavities inserted	496
Cold-coated mixes	488
Cope and drag swell measurement	485, 487
Defect formation, effect on	461
Designing of gating	313
Direct and indirect pressure-type gates	314
Dry shell mixes	486, 487
High temperature expansion	488
High temperature tests	486
Metal poured for tests	485
Mixing procedure	484
Mold composition, effect	462
Mold design, for tests	459
Pattern equipment, gating and risering	312-314
Patterns and core boxes, construction of	495-496
Placing gates and risers	314
Planning gating system	312, 313

- Shell Mold (continued)
- Plate defect 489
 - Pouring 485
 - Pressure-type gates 313, 314
 - Primary steps to consider in construction 495
 - Problems of 312
 - Rattail defect 489
 - Reaction mechanisms 462, 463
 - Resins used 484
 - Sands used 484, 486
 - Section size, effect 460, 461
 - Shell bonding 485
 - Shell making 484
 - Shell tensile strength 486
 - Silicon-oxygen reactions 462
 - Size distribution, sand used 461
 - Sprue and runner basins 313
 - Standardization of parts 496
 - Strengths of shell mixes 486
 - Surface imperfections in large 459
 - Temperature, effect 460
 - Test data and results, cold-coated mixes 492-494
 - Test data and results, dry mixes 489-492
 - Test pattern 484
 - Use of gates 313
- Shell Molding
- Advantages 82
 - Automatic transmission casting 81, 82
 - Average deviations 85
 - Calcium carbonate effect 405, 406
 - Calcium boride 71
 - Composite molds 407
 - Copper, deoxidation practice 69-73
 - Deterrent to steel castings 403
 - Differential case test 83
 - Dimensional accuracy 81
 - Dimensional control 81
 - Dimensional variation 559
 - Dissociation temperature, calcium carbonate 406
 - Electrical conductivity 70, 71, 72
 - Embrittlement, hydrogen 69, 70
 - Enthalpy changes 406
 - Equations for calculating deoxidation 69
 - For steel castings 403-408
 - Forsterite effect 404
 - Histograms, distribution frequency 84, 85
 - Hydrogen pickup 72, 73
 - Hydrogen vs. copper oxide 69, 72
 - Liquid bonding resin 81, 82
 - Manganese dioxide effect 405, 406
 - Molding practice 70
 - Mold material coefficients 405
 - Oxygen 70
 - Pattern dimensions 83
 - Problems, production 560
 - Process, capability evaluation 81-86
 - Quality control 560
 - Reaction equilibrium, carbon and carbon dioxide 406
 - Sand and sand-resin mixtures 559-560
 - Shell core blowing 84
 - Shell core dimensions 85
 - Skip formation
 - Surface defect causes 403, 404
 - Survey of 559-560
 - Thermal conductivity, olivine 405
 - Titanium effect on deoxidation 71
 - Zircon effect 404, 405
- Shrinkage
- Distribution, gray iron 371
- Silica
- Reduction, large shell molds 459-465
- Silica Flour
- Bonded sands 7
 - Eliminates metal penetration 6
 - Hot deformation vs. 10, 11
- Silicon
- In pearlitic malleable iron 16
 - Losses in cast iron 17
 - Low, in cast iron 17
 - Raises oxygen content 17
 - of scrap effect, cupola tapping temperature 397-398
- Sodium Silicate
- Bonded sand, hardening 91-95
 - Bonding characteristics 318-319
 - Colloidal nature of 316
 - Composition after gassing 320
 - Composition of 317
 - Compressive strength vs. gassing 321
 - Concentration vs. viscosity 316
 - Density vs. composition 316
 - Dry strength 322
 - For the carbon dioxide process 315-320
 - Mixing order 318
 - Mixing order vs. gassed strength 318
 - Physical characteristics 317
- Solidification
- Mechanism, gray iron risering 49, 50, 54
 - Pressure vs. microporosity, aluminum alloys 129-134
 - Vs. interface temperature 213-221
- Solution Treatment
- Aluminum-copper alloys effect 96-103
- Specifications
- Purchasing steel mold and core sand binders 125-128
 - Steel scrap, duplexing cupola white iron 268-270
- Steel
- Cast, effect of vanadium on mechanical properties 425-432
 - Castings, factors affecting toughness 344-348
 - Castings, resistance to abrasion 187-196
 - Investment casting, sintered alumina molds 247-251
 - Mold penetration depth 4
 - Mold, purchase specifications 125-128
- Steel Castings
- Abrasive hardness influence 195
 - Abrasive hardness vs. wear rates 195
 - Acid or basic steel 344, 345
 - Acid slag viscosity vs. metal quality 346
 - Alloying elements effect 191
 - Alloy recovery from slag 346
 - Austenitic steels 193, 194
 - Austenitizing temperature vs. wear rates 190
 - Boil phase effect 345
 - Calcium carbonate effect 405, 406
 - Carbon content vs. abrasion resistance 191
 - Carbon steel 345
 - Composite shell molds for 407
 - Deterrent to shell molding of 403
 - Dissociation temperature, calcium carbonate 406
 - Enthalpy changes, shell molding 406
 - Factors affecting toughness 344-348
 - Forsterite effect 404
 - Hydrogen effect 345, 346
 - In ball and rod mills 188
- Steel Castings (continued)
- Iron oxide in slag vs. metal quality 346
 - Manganese dioxide effect 405, 406
 - Martensitic steels vs. martensitic white irons 192
 - Mold material coefficients 405
 - Pearlitic steels 192, 193
 - As-cast vs. normalized 192
 - Carbon effect 193
 - Hardness effect 193
 - Pearlite and bainite 193
 - Tempering effect 193
 - Reaction equilibrium, carbon and carbon dioxide 406
 - Reduction of area 344-347
 - Resistance to high stress abrasion 187-196
 - Rockwell hardness 188
 - Shell molding for 403-408
 - Short-time wear test 188
 - Skin formation 405
 - Slag and temperature adjustment 346
 - Slag-metal reactions 347
 - Slag vs. metal quality 348
 - Solidification equation 405
 - Sulfur effect 344, 345
 - Surface defect causes, shell molding 403, 404
 - Tap-hole size vs. metal quality 347
 - Tempering vs. abrasion resistance 191
 - Tensile strength 344
 - Thermal conductivity, olivine 405
 - Time vs. wear testing materials 188
 - Wear rates, liner steels 189, 190
 - Zircon effect 404, 405
- Steel Scrap
- Cost vs. loss 269
 - Loss reduction through control 270
 - Melting loss due to scrap preparation 269, 270
 - Raw material cost per ton 269
 - Specifications, duplexing cupola white iron 268-270
 - Steel melting scrap 270
 - Undesirable, effects 268, 269
- Structural
- Considerations, nodular iron 56-58
- Sulfur
- Magnesium, nodular iron vs. 58
- Surface Tension
- Ammonia effect 291-293
 - And contact angle, helium 290, 291
 - Equations for calculating 294
 - Liquid, measurement 290, 291
 - Nitrogen effect 291-293
 - Oxygen effect 291, 292
 - Penetrating pressure vs. 2
 - Water vapor effect 291-293
- T
- Temperature
- And atmosphere effect, iron-silica interface reaction 452-458
 - High and low, mechanical properties, cast steel, vanadium effect 425-432
 - High, properties, shell molds 484-494
 - Interface vs. solidification 213-221
 - Metal, increase, lessens penetrating pressure 5
 - Pouring, increases metal penetration 1
 - Pouring, pinholing effect 28
 - Tapping, coke needed to produce 398

Temperature (continued)

- Tapping, cupola, scrap size effect397-398
- Vs. hot deformation8, 9
- Vs. penetrating pressure 2

Tensile

- Cast bar molds, improved design284-287
- Properties, AZ-63 magnesium alloy409-414

Tin

- Penetrating pressure vs. temperature 2
- Ramming vs. penetrating pressure 3

Titanium Castings

- As-cast surfaces228
- Carbon contamination225, 226
- Chemical analysis, ingot227, 228
- Chemical reactivity226
- Consumable electrode-vacuum arc furnace135
- Difficulties with225
- Heat treatments227
- High strength, by induction melting225-230

- Knoop hardness vs. distance into metal139, 141

- Macroetch surface228

- Mechanical properties228, 229

- Melting process226

Molds, graphitic

- Absolute permeability,* equation136
- Baked compressive strength vs. per cent water138
- Compressive strength .136, 137, 141
- Fired compressive strength vs. mold pressure138

Titanium Castings (continued)

- Green compressive strength vs. per cent water138
- Material composition136
- Penetration137, 140
- Permeability136, 138, 141
- Permeability vs. per cent water..139
- Preparation procedure142
- Rammed material for135-142
- Refractories135
- Sieve analysis, electric furnace graphite135
- Optimum strength-ductility230
- Shrinkage136, 137
- Surface contamination137, 139
- Surface evaluation136, 137
- Thermal conductivity ..137, 139, 140

Toughness

- Factors affecting, mild steel castings344-348

Treatment

- Chemical, copper alloys271-277
- Heat, vs. tensile properties, nodular iron153, 154

U

Undercooled Graphite

- Formation18, 561-568

V

Vacuum

- Die casting, progress in199-202

Vanadium

- Mechanical properties, effect on cast steel425-432

Voids

- Determine penetrating pressure .. 6
- Size, pressure and temperature work together 6

W

Washes

- Alleviate metal penetration 4
- Detergents make effective 4
- Silica flour effect 4
- Zircon flour effect 4

Wear

- And buildup, material, dust piping to prevent418-420

White iron

- Duplexing, cupola, steel scrap specifications268-270
- Pinholing defects, causes and types of31-35

Wood Flour

- Additions vs. hot deformation ..10, 11

Work Sampling

- Acceptable tolerances in580
- Confidence levels of579-580
- Day-to-day variation in579
- Nomographs for580, 581
- Observation interval for579
- Step-by-step procedure in ..581-582
- Technique, practical application of578-582
- Theory of random sampling in578-579

Z

Zinc

- Aluminum-Magnesium casting alloy222-224

